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evidence stands, it is not absolutely proven that a group of animals having all the characters exhibited by a species in nature has ever been originated by selection, whether artificial or natural.”<sup>1</sup>

LONDON, October 4, 1876.

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## EDUCATED FLEAS.

BY W. H. DALL.

IN old-fashioned “annuals” and especially in obsolete works on instinct and intelligence among the lower animals, accounts of the so-called “Educated Fleas” will doubtless be remembered by my adult readers. The story of their marvelous performances had for my boyhood a peculiar interest not un-mixed with incredulity. In later years I had begun half-unconsciously to class them with the spurious marvels of the “automatic chess player” and the generation of *Acari* by the action of electricity on chemicals. So far as my mind was occupied with the subject at all, it had concluded on general principles that intelligent action, of the kind described in the old works referred to, could be attributed to fleas with very little probability; and that, whatever the innate mental ability possessed by them, it was in the highest degree unlikely that it was susceptible of training.

Some weeks ago, when passing through Broadway, New York, not far from Union Square, an accidental glance caught the sign over a doorway, “Exhibition of Educated Fleas.” Past memories and present curiosity determined me to make an inspection at once. Half an hour later I had seen all there was to see, purchased a lively little pamphlet by — shall I say the *inventor* of the educated fleas? and decided that the small fee exacted was well expended. As it does not appear that the *modus operandi* of this exhibition has ever been explained, an attempt in that direction may not be uninteresting to the readers of the Naturalist.

To make the explanation intelligible it will be necessary to begin with the conclusion, or in other words to first state the essential part of the explanation.

First, the fleas are not educated.

Second, all the performances which make up the exhibition may be traced directly to the desire and earnest efforts of the insects to escape. The means employed to give an appearance

<sup>1</sup> Lay Sermons, page 323 (English edition).

of intelligent action to these struggles are sufficiently ingenious.

In the first place, each flea is attached to some object in such a manner that it cannot free itself, while the movements of its legs and feet are not hindered or embarrassed.

This was explained by the proprietor. The surface of the insect is so polished that no cement will adhere to it when dry, and should a soft or waxy substance be used the insect dies very soon. (A probable cause of this might be the obstruction of the stigmata.) He stated that by tying a single silk fibre around the flea and knotting it on the dorsal side, a bristle, fine wire, or what not, may be cemented to the knot. I was not able to observe exactly where the fibre encircled the insect. This part of the process is the most delicate and difficult to perform.

The proprietor states that female fleas are solely employed by him, since the males are "excessively mulish and altogether disinclined to work." The fact that they are much smaller and weaker than the other sex is probably another and more important reason, and they are said to die in a few days when closely confined.

The first preparation for their task is stated to be as follows: the wild flea is put into a small pill-box with a glass top and bottom, revolving on an axis like a lottery wheel and forming a miniature treadmill. After a few days' confinement herein, the flea, which in a state of nature is, as we know, excessively inclined to jump, becomes broken of the habit. It is said that the constant raps which it receives, when attempting to jump and thereby hitting the sides of its prison, incline it to walk. If this be true, and it might readily be tested by experiment, the flea's education is entirely comprised in it, and, so far as it goes, it is a species of training. I am not yet convinced of the accuracy of the statement. A "wild" flea was shown, attached by one foot to a minute ball and chain, and certainly jumped continually. If a "tame" or educated specimen had been similarly weighted, and had showed no desire to jump, it would have indicated the truth of the theory, provided its legs were found to be sound. This, however, was not done, and all the "tame" ones, having something on their backs, might thereby be affected differently from one confined only by one "foot."

The performances may be divided into two classes: first, by fleas attached to a movable object; and second, by fleas attached to an immovable object. The former (with one exception) are

employed in pulling, pushing, or carrying some object about. This portion of the exhibition is a genuine exposition of the very extraordinary strength in proportion to its size, which is possessed by this little insect. Small and beautifully executed models of horse-cars, vessels, coaches, a wheelbarrow, butterfly, etc., are pulled about, each by a single flea attached firmly to a minute pole or wire, extending from or under the object. Small bits of silk, tissue paper or other light material are attached to the knot on the flea's back, and by courtesy are termed dresses, or equestrians as the case may be.

The proprietor states that the weight of a flea is about 0.05 of a grain, or, if well fed, 0.1 grain. He states that the model of the street car exhibited weighs one hundred and twenty grains or about twelve hundred times the weight of the flea which drags it. Whether these figures be precisely accurate or not, it is a very remarkable effort for so small a creature. Vigorous specimens are said to occur which are able to pull even a considerably larger weight.

The fleas from dogs are less strong than the human parasite, and require more frequent feeding. The ordinary flea will remain four days, it is said, without injury for want of nourishment, and will live for weeks, though diminishing in weight. They are said to live about a year; the performers average eight months, but one is recorded by the proprietor as having lived twenty-three months in his possession, the last two of which were passed in a state of great weakness.

It was noticeable that the surface over which the fleas dragged their burdens was composed of compact blotting paper on which their hooklets took good hold, and that whenever the performance of any one individual was not going on, the particular object to which it was attached was laid on its side, or so that the insect was left, feet in air, where it could not exhaust itself by unnecessary efforts. I think that the absence of any proof of education in the above cases is quite plain.

In the second class of cases the efforts made by the flea to escape are precisely the same, but, being fixed itself, it must necessarily show its power by traction upon some movable object or by aimless gesticulations in the air.

Generally the insect is attached to a sort of style or wire in a perpendicular position with the head uppermost and the limbs extended horizontally. Usually it will remain quiet, but if disturbed by the vibration of its wire, as produced by knock-

ing on the table, it will work its limbs about, seeking something to take hold of. If, then, segments of finest wire, fans of tissue paper, or other representations of objects in miniature are attached to its fore "feet," we shall have it apparently brandishing a stick or sword, fanning, performing on a musical instrument, etc., all of which is much more clearly seen with the aid of a lively imagination.

Two fleas furnished with segments of finest wire on their fore "feet," and placed with their ventral sides so near that the mimic swords can touch, but not the insects' feet, give a representation of a duel not much worse than that usual in most theatres. In their struggles to reach the adjacent object, it would be strange if the little wires did not clash occasionally.

"Madame Lenormand," "Rebekah at the Well," and a flea turning a miniature windmill are brought, each on its perch, so near an endless chain of ingeniously minute workmanship, that their hooklets catch in the links, and they eagerly seize the opportunity of pulling themselves, as they suppose, away from their bonds. The only result is that a little pointer turns to a number on a dial, a little bucket comes out of a well-curb, or the mill goes round. A similar but horizontally applied motion propels a little merry-go-round.

The most amusing and, at first, most incomprehensible of the various performances, is that of the dancing fleas. The orchestra are placed above a little music-box, whose vibrations cause them to gesticulate violently for a few moments, fastened as they are to their posts. Below them several pairs of fleas (fastened by a little bar to each other in pairs, those of each couple just so far apart that they cannot touch each other) are apparently waltzing; an inspection shows that the two composing each pair are pointed in opposite ways; each tries to run away, the "parallelogram of forces" is produced; the forward intention, converted to a rotary motion, ludicrously imitating the habits of certain higher vertebrates.

I have sketched the plan of the performance, and it will be noticed that there is nothing in it which cannot be explained on the hypothesis with which we set out, namely, that all the effects produced may be the result of the natural efforts of the insect to escape, the burden of proof being with those inclined to a contrary opinion. Whatever the result to our opinion of the flea's mental powers, one can hardly avoid admiring the ingenuity with which the "stage property" has been fitted to its purpose, and the beauty of the models and apparatus.

The exhibitor claims to feed his swarm on his own arm, which exhibited a sufficiency of punctures. His whole company may be packed into a shaving-box and put in his coat-tail pocket. He claims to have originated the exhibition forty years ago. Some of the anecdotes in his little pamphlet are amusing enough, and we find the following contributions to the Natural History of the Flea.

“The flea may be easily dissected in a drop of water, and by this means the stomach and bowels may be plainly discovered, with the veins and arteries” (!) Their “amazing motion is performed by means of the great elasticity of their feet, the articulation of which are so many springs, in accordance with the exalted and lofty aspirations of the insect.” And finally, “Take a well fed — (*Cimex*) and a starved flea, and place them under a glass together, and you will be afforded an amusing spectacle. The flea as soon as he perceives the pury condition of the bug will hop upon its back, and, in spite of the latter’s struggles to throw him off, will succeed in extracting the blood from the bug’s body, leaving it in quite a lean condition, while the flea becomes round, plump, and happy, after its beneficial ride.”

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## THE GIANT BIRDS OF NEW ZEALAND.

BY I. C. RUSSELL.

OF the many remarkable additions that New Zealand has made to the various branches of natural science, none have attracted greater attention, or called forth more exclamations of wonder, than the remains of the giant birds that at no very distant day inhabited those antipodal islands.

In order that we may more fully understand the bearings and relations of our subject, let us glance for a moment at the present inhabitants of New Zealand, many of which are very strange and interesting. Aside from the aborigines, who are an offshoot of the ancient Polynesian family, the first feature that attracts our attention is the total absence of land mammals. The dog and a small species of rat are sometimes spoken of as being natives of New Zealand, but they more likely accompanied the aborigines in their wanderings, or were introduced by the earlier voyagers. The reptiles are almost as great strangers in those islands as are the mammals, being only represented by a few species of harmless lizards, which are very plentiful in individ-